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Arsenic Concentrations of Deer and Elk Tissue from

Upper Prospect Creek, Montana

U.S. Army



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March 1985

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KEYWORDS

Air
-
- effects, air pollution -
Hazardous materials -
Toxicity -
Montana -

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Chapter 1

INTRODUCTION

In July 1984, a dead white-tail fawn of that year was found within the fence enclosing the U.S. Antimony tailings pond in Prospect Creek, and liver, kidney, and rumen tissues were obtained from this rapidly decomposing animal. The Montana Criminal Investigation Laboratory analyzed the tissues and found 50.2 parts per million (ppm)* arsenic in the liver and 42.2 ppm arsenic in the kidney. Reports from two veterinary pathologists cited arsenic levels in liver, kidney, or rumen ranging from 10 to 20 ppm as being indicative of severe if not lethal exposure to arsenic.

(Appendix A)

By September 18, 1984, the Montana Department of Fish, Wildlife, and Parks had developed a plan to sample deer, elk, and fish in the Prospect Creek drainage. In addition, the Department of State Lands notified U.S. Antimony of shortcomings in its operation, including the need for a deer/elk proof fence.

An anonymous telephone call on October 18 to the Thompson Falls newspaper resulted in articles in several Montana newspapers concerning the dead deer and the proposed study. (Appendix B) Shortly thereafter, the Department of Fish, Wildlife, and Parks notified hunters in the Prospect Creek area about the potential arsenic contamination of big game animals.

(Appendix C)

*1 part per million = 1 μ g/gram

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In October 1984, the Gordon Environmental Laboratory received 24 samples of big game tissue from the Department of Fish, Wildlife, and Parks at Thompson Falls. These samples consisted of liver and muscle tissues from elk, white-tail deer, and mule deer.

The Gordon Laboratory prepared the samples for arsenic analysis by atomic absorption spectrophotometry (AAS) employing the hydride generator technique. The samples were freeze-dried, ground to pass a #20 mesh screen, and digested in nitric acid in sealed pyrex tubes. The resultant digests were split for analysis by the Gordon Laboratory and the Montana Criminal Investigation Laboratory, Division of Forensic Science, Missoula. In addition, the Gordon Laboratory provided quality assurance checks for both laboratories. Upon completion of the analysis, the Montana Department of Fish, Wildlife, and Parks supplied collection locations for the samples to enable the Gordon Laboratory to prepare this interpretative report.

The letter of agreement between the Department of Fish, Wildlife, and Parks and the Gordon Laboratory is included as Appendix D.

This report details the methods and the results of arsenic analysis on the tissue samples by the Gordon Environmental Laboratory and the Montana State Criminal Investigation Laboratory; the quality control and quality assurance procedures employed and the conclusions reached and the recommendations offered by the authors.

A brief chronology of events from 1969 through the fall of 1984 is included as Appendix E.

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Chapter 2

Materials and Methods

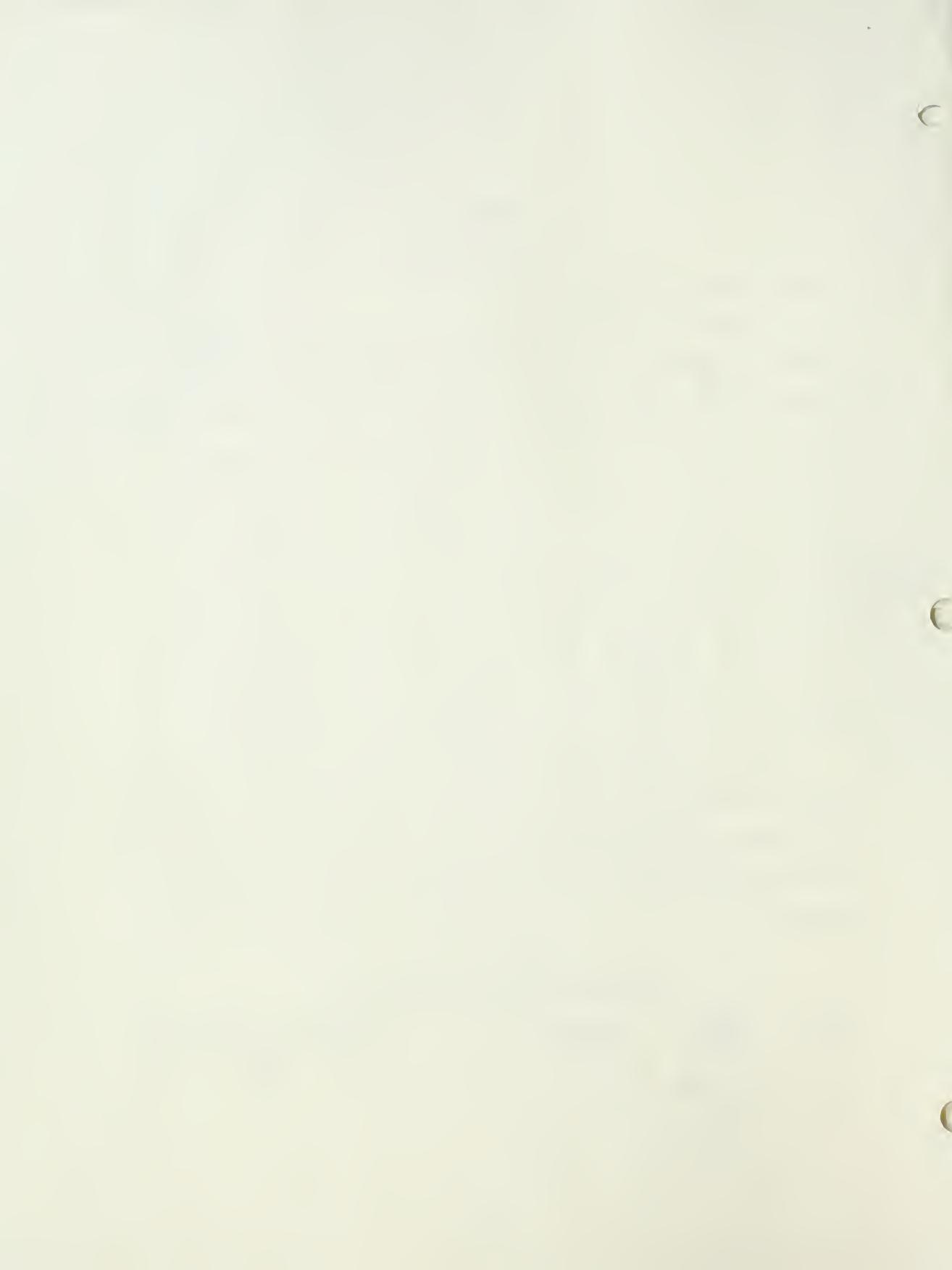
Sample Handling and Preparation

On October 29, 1984, 24 samples of liver and muscle tissue were submitted to the Gordon Environmental Laboratory for arsenic analysis by Shawn Riley, Montana Department of Fish, Wildlife, and Parks, Thompson Falls. (Appendix F). The samples were freeze-dried in acid-washed plastic petri dishes and then ground in a Wiley Mill to pass a 20 mesh screen. For each sample, 0.3 gram of ground tissue was dissolved in 15 milliliters of trace metal analysis grade nitric acid in a sealed-tube pressured system for 3 hours at 150 degrees centigrade. Excess nitric acid was removed by evaporation of the digests to near dryness on an electric hot plate. The samples then were brought back to a final volume of 10 milliliters in a 0.3 M trace metal analysis grade nitric acid matrix.

A total of 43 samples were prepared for arsenic analysis. These included the original 24 samples, duplicate samples, samples of known addition (spikes), and quality assurance/quality control reference standards. The sample numbers, sample type, and treatment of these samples is shown in Table I.

Table 1.
Sample Number, Type and Treatment

<u>Sample #</u>	<u>Type</u>	<u>Treatment</u>	<u>Criminal Laboratory Split</u>
1.1	Tissue	None	No
2.1	"	"	Yes
3.1	"	"	"
4.1	"	"	"
.4.2	Split of 4.1	"	"



<u>Sample #</u>	<u>Type</u>	<u>Treatment</u>	<u>Criminal Laboratory Split</u>
4.3	Split of 4.1	S ^a	Yes
4.4	"	S ^b	"
5.1	Tissue	None	"
5.2	Split of 5.1	"	"
5.3	"	S ^c	No
5.4	"	S ^d	No
6.1	Tissue	None	Yes
7.1	Tissue	"	"
8.1	"	"	"
9.1	"	"	"
10.1	"	"	"
11.1	"	"	"
11.2	Split of 11.1	"	No
11.3	"	S ^a	Yes
11.4	"	S ^b	"
12.1	Tissue	None	"
13.1	"	"	"
14.1	"	"	"
15.1	"	"	"
16.1	"	"	"
17.1	"	"	"
17.2	Split of 17.1	"	"
17.3	"	S ^c	No
17.4	"	S ^d	No
18.1	Tissue	None	Yes
19.1	"	"	"
20.1	"	"	"
21.1	"	"	"
22.1	"	"	"
23.1	"	"	"
24.1	"	"	"
24.2	Split of 24.1	"	"
24.3	"	S ^a	"
24.4	"	S ^b	"
25.1	NBS ^c	None	"
26.1	"	"	"
27.1	NBS ^d	"	"
28.1	"	"	No

S^a = Known addition of 100 nanograms of arsenic before digestion

S^b = Known addition of 200 nanograms of arsenic before digestion

S^c = Known addition of 100 nanograms of arsenic after digestion

(*c*)

(*c*)

(*c*)

S^d = Known addition of 200 nanograms of arsenic after digestion

NBS^c = National Bureau of Standards Standard Reference Material 1571,
Orchard Leaves

NBS^d = National Bureau of Standards Standard Reference Material 1577a,
Bovine Liver

Of the 43 digests prepared for analysis, 36 were split into 5 milliliter aliquots. One of each of these splits was submitted to the State Criminal Investigation Laboratory (Table 1 and Appendix G). The remaining split was retained and analyzed by the Gordon Laboratory.

All blanks and calibration standards at the Gordon Laboratory were prepared in a 0.3 M nitric acid trace metal analysis grade matrix. For instrument calibration, the Gordon Laboratory used standard concentrations of 2.5, 5.0, 10.0, 20.0, and 30.0 parts per billion (ppb) arsenic, while the Criminal Investigations Laboratory employed 5.0, 10.0, and 20.0 ppb calibration standards.

Arsenic Analysis

The method of arsenic analysis employed at both laboratories was vapor generation flame atomic absorption spectrophotometry. Arsenic is reduced in this procedure to arsine (a gas) in a hydride generator, and the arsenic is then measured by flame atomic absorption spectrophotometry.

Both laboratories utilized Varian instrumentation for the arsenic analysis, the Criminal Investigations Laboratory employing a Varian 875 AAS, the Gordon Laboratory a Varian 275 BD unit. Each instrument was equipped with a model 65 generator and a deuterium lamp background correction system.

The following instrumental conditions and parameters were employed for arsenic analysis:

	U of MT	State Criminal Laboratories
Wavelength:	193.7 nanometers	193.7 nanometers
Slit Width:	1.0 nanometers	1.0 nanometers
Lamp Current:	8.0 mA	7.0 mA
Integration Time:	30 seconds	30 seconds
Mode:	Peak height	Peak height
Purge Time:	25 seconds minimum	25 seconds

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Quality Control and Quality Assurance

Quality Control may be defined as those routine practices and procedures which provide for the reliability of data. Examples of Quality Control procedures employed at the Gordon Laboratory are:

1. Use of trace metal analysis grade reagents.
2. Use of calibrated balances.
3. Acid cleaning of all glassware and plasticware.
4. Use of distilled/deionized water.
5. Instrument calibration before each analytical run.
6. Analysis of calibration standards, reagent, method blanks, and reference standards at the 10% frequency within each analytical run.
7. Chain-of-custody documentation for all samples submitted.

Quality Assurance may be defined as those activities which function to determine the quality of data in terms of accuracy and precision and to assure that quality control procedures are sufficient to achieve their purpose.

Examples employed are:

1. Analysis of National Bureau of Standards Standard Reference Materials.
2. Analysis of U.S. EPA Quality Assurance certified standards.
3. Analysis of samples treated by known addition of two levels of arsenic (spiked samples).
4. Analysis of duplicate, triplicate and/or split samples.
5. Review of analytical data prior to and after reduction.
6. Comparison of analytical results of standard reference materials with certified and control limit values.
7. Determination of accuracy and precision.

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Chapter 3

RESULTS

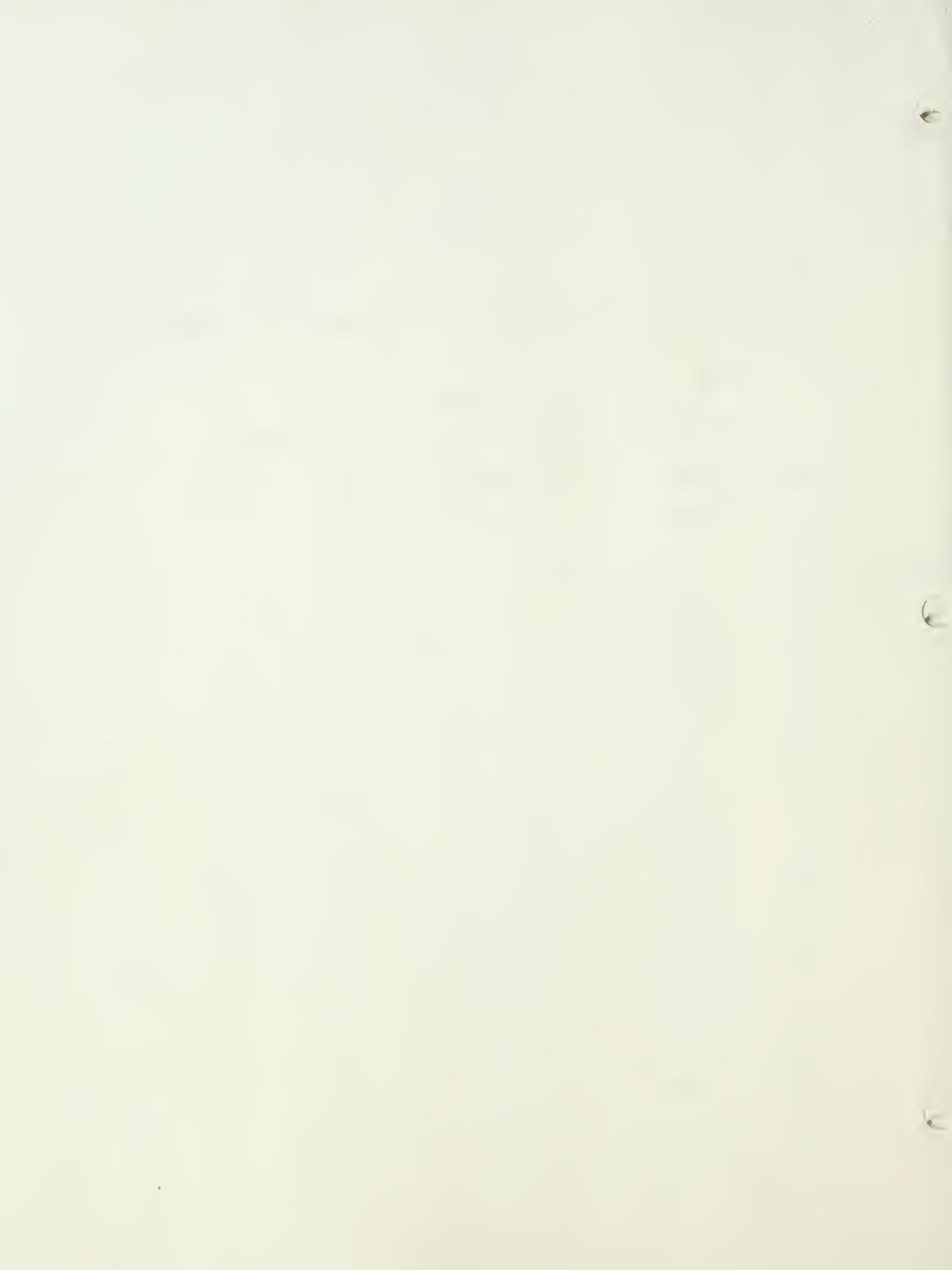
Arsenic Analyses

The results of arsenic analysis of big game samples are shown below in Table 2:

Table 2

Results of Arsenic Analysis in Parts Per Million

<u>Sample #</u>	<u>Type</u>	<u>Treatment</u>	<u>UM^a</u>	<u>CIL^b</u>
1.1	Tissue	None	< 0.08	-
2.1	"	"	"	< 0.2
3.1	"	"	"	"
4.1	"	"	"	"
4.2	Split of 4.1	"	"	"
5.1	Tissue	"	"	"
5.2	Split of 5.1	"	"	"
6.1	Tissue	"	"	"
7.1	"	"	"	"
8.1	"	"	"	"
9.1	"	"	"	"
10.1	"	"	"	"
11.1	"	"	"	"
11.2	Split of 11.1	"	"	-
12.1	Tissue	"	"	< 0.2
13.1	"	"	"	"
14.1	"	"	"	"
15.1	"	"	"	"
16.1	"	"	"	"
17.1	Tissue	"	"	"
17.2	Split of 17.1	"	"	"
18.1	Tissue	"	"	"
19.1	"	"	"	"
20.1	"	"	"	"
21.1	"	"	"	"
22.1	"	"	"	"
23.1	"	"	"	"
24.1	"	"	"	"
24.2	Split of 24.1	"	"	"



a = Results of University of Montana, Gordon Environmental Laboratory

b = Results of Criminal Investigation Laboratory

The results of arsenic analysis of Standard Reference Materials and U.S.

EPA Quality Control Certified Standards are shown below in Table 3:

Table 3

Arsenic Analyses in Parts Per Million of
Reference and Certified Standards

<u>UM Sample #</u>	<u>Reference</u>	<u>True Value</u>	<u>UM^a</u>	<u>CIL^b</u>
25.1	1571 ^c	10 ± 2	9.5	> 3
26.1	1571 ^c	10 ± 2	8.8	> 3
27.1	1577 ^d _a	0.047 ± 0.006	< 0.08	< 0.2
28.1	1577 ^d _a	0.047 ± 0.006	< 0.08	-
-	WP004(2) ^e	0.06 ± 0.03	0.05	-
-	WP006(2) ^f	0.23 ± 0.07	0.25	-

a = University of Montana Gordon Environmental Laboratory

b = Criminal Investigation Laboratory

c = National Bureau of Standards SRM 1572, Orchard Leaves

d = National Bureau of Standards SRM 1577a, Bovine Liver

e = US EPA, EMSL, Cincinnati, QC Water Standard WP004 Concentration #2

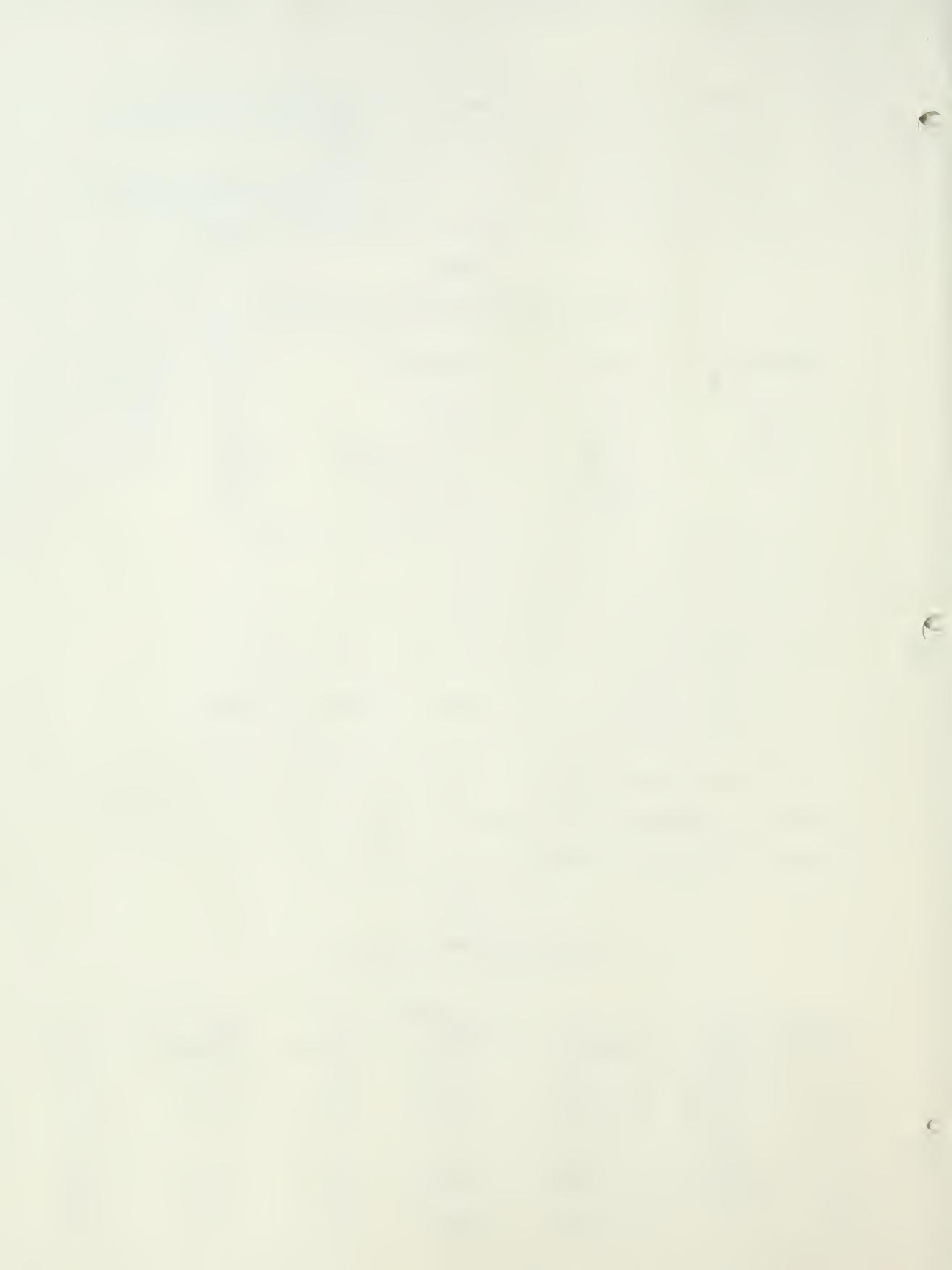
f = US EPA, EMSL, Cincinnati, QC Water Standard WP006 Concentration #2

Ten samples were treated with known additions (spikes) of arsenic before digestion to evaluate arsenic recovery. The treatments, amounts of arsenic added and the recovery of arsenic are shown in Table 4:

Table 4

Recovery of Known Additions of
Arsenic Before Digestion

Sample #	Type	Treatment ^a	UM		CIL	
			Amount ^b Recovered	% Recovery	Amount Recovered ^{b,c}	% Recovery
4.3	Split of 4.1	0.1 ug As	0.06 ug	120	0.07	140
4.4	"	0.2 ug As	0.12 ug	120	0.09	90
11.3	Split of 11.1	0.1 ug As	0.04 ug	80	0.07	140
11.4	"	0.2 ug As	0.10 ug	100	0.12	120
24.3	Split of 24	0.1 ug As	0.06 ug	120	0.05	100
24.4	"	0.2 ug As	0.10 ug	100	0.12	120



a = Arsenic added before digestion of samples

b = Digests were split prior to analysis. Therefore, only one-half of added arsenic (0.1 or 0.05 ug) could be recovered.

c = On the date these analyses were made, the Criminal Investigation Laboratory experienced problems with analytical precision.

In addition to known addition treatment before analysis, four samples were spiked after digestion to evaluate matrix effects. The recovery results are shown in Table 5. These samples were not split prior to analysis and the analyses were performed at U of M.

Table 5

Recovery of Arsenic Added After Digestion

<u>Sample #</u>	<u>Type</u>	<u>Treatment</u>	<u>Amount Recovered</u>	<u>% Recovery</u>
5.3	Split of 5.1	0.1 ug As	0.09 ug	90
5.4	"	0.2 ug As	0.18 ug	90
17.3	Split of 17.1	0.1 ug As	0.09 ug	90
17.4	"	0.2 ug As	0.19 ug	95

Accuracy

Accuracy is the degree of agreement between a measured value and the "true", "known", "certified", or, more appropriately, the accepted value of an analyte in a substrate.

The results of arsenic analysis of Reference and Certified Standards used to determine accuracy are reported in Table 3 and reproduced, in pertinent part, below in Table 6.

Table 6
Results of Arsenic Analysis of Standards
In Parts per Million

<u>Standard</u>	<u>True Value</u>	<u>UM Result</u>	<u>CIL Result</u>
NBS 1571	10 ± 2	9.5	> 3
" "	10 ± 2	8.2	> 3
NBS 1577a	0.047 ± 0.006	< 0.08	< 0.2
" "	0.047 ± 0.006	< 0.08	-
EPA WP004 (2)	0.06 ± 0.03	0.06	-
EPA WP006 (2)	0.23 ± 0.07	0.25	-



As can be seen from Table 4, the results from UM for NBS 1571 and EPA WP004 (2) and WP006 (2) are within the uncertainty bounds of the true values. The results for NBS 1577a are reported as less than 0.08 parts per million. NBS 1577a was included as illustration of results obtained from samples with very low dry weight arsenic concentrations.

Because the Criminal Investigation Laboratory was provided only with sufficient volumes of digest for one analysis, their results are reported as greater or less than the certified value, as would be expected.

The other assessment of accuracy employed was recovery of added arsenic, or spikes (Tables 4 and 5). The average percent recovery for arsenic added before sample digestion was 106.6% at UM and 118% at the Criminal Investigation Laboratory. Experience has shown that recoveries of between 80% and 120% are to be expected, depending on the sample matrix. The mean percent recovery of arsenic added after digestion was 91.3% (Table 5), in comparison to an expected recovery of between 80% and 120%.

Precision

Precision is the degree of agreement between repeated measurements of a sample and is a statement of the magnitude of the random error inherent in all measurements made in the real world.

Split and repeat analyses were used to determine precision. Because all deer tissue samples were below working range concentration, it is not possible to calculate the measurement precision of these samples. Repeat analyses of EPA WP004 (2) gave relative standard deviation of 9.6%.

Relative standard deviations for Calibration verification standards are shown in Table 7.



Table 7

Relative Standard Deviations (RSD) of
Calibration Verification Standards

Standard Concentration (ppb)	UM RSD
2.5	3.8
5.0	3.4
10.0	11.4
20.0	0.20
30.0	1.8

The coefficients of determination for calibration standards for the Criminal Investigation Laboratory on the two days which big game samples were analyzed there were 0.99 and 0.98, respectively.

Repeat Analysis of Samples Collected in July 1984

Efforts to obtain archived original samples or splits of samples used for analysis were not successful. No such samples exist (Shawn Riley, FWP; Jim Hutchison, State Criminal Investigation Laboratory, Personal Communication).

It was learned that the deer sampled at the settling pond in July was rapidly decomposing, that the body cavity had been opened by carrion feeders, and the carcass was badly infested with larvae (Appendix H). Secondary contamination was grossly evident on samples submitted for analysis (Jim Hutchison, State Criminal Investigation Laboratory, Personal Communication). This is not surprising given the state of the carcass and the totally undesirable conditions under which the organs were collected from it (Appendix H).

No reason was found to question the validity of the actual arsenic analysis of the liver and kidney samples (Appendix I).

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Chapter 4

SUMMARY AND CONCLUSIONS

Summary

Twenty-four big game tissue samples were analyzed for total arsenic concentration. The results showed all samples contained less than 0.08 to ≈ 0.2 parts per million arsenic. Nineteen quality control/quality assurance samples were processed with the tissue samples. Analytical results of National Bureau of Standards Reference Materials and US EPA Certified Standards were within the control limits of arsenic concentrations. Recovery of arsenic from samples treated by known addition techniques were also within pre-determined control limits. Formal, documented chain-of-custody procedures were adhered to upon receipt of the samples by the Gordon Environmental Laboratory.

The samples submitted for analysis consisted of liver or muscle tissue from deer and elk ranging in age from 0.5 to 7.5 years. Both Mule and Whitetail deer were included in the samples. The majority were collected within three miles of the U.S. Antimony site in Prospect Creek while others were taken at greater distances (Appendix J).

There is no apparent reason to question the validity of the arsenic analyses of the samples collected from the carcass at the settling ponds in July 1984. A recent report (Appendix K) indicating error in the analyses of these samples is in conflict with available information.

Following the Tri-Creek Fire in the early part of the 1970's, a report was prepared in which arsenic concentrations in soils and conifers in the vicinity of the U.S. Antimony facility in Prospect Creek were detailed (Clint Carlson, USDA Forestry Sciences Laboratory, Personal Communication).



Copies of Laboratory reports of X-ray Fluorescence analysis of duff, fir needles, and other media were obtained of samples collected following the Tri-Creek Fire (Appendix L). While it is not possible to determine the actual arsenic concentrations from Appendix L, the presence of arsenic in environmental samples collected then was detected.

Conclusions

1. Arsenic concentrations in samples as received in October 1984 were all less than 0.08 - 0.02 parts per million, irrespective of age, sex, species, or location of collection.
2. Arsenic concentrations in the as received samples collected from the carcass at the settling pond site in July 1984 cannot unequivocably be stated to have been inherent to the tissues because of secondary contamination. The arsenic may have been solely inherent in the tissue; it may be solely a result of secondary contamination; it may have been a combination of both.
3. The arsenic concentrations reported in the samples collected in July 1984 cannot be used for diagnostic or evaluation purposes.
4. There is a lack of reliable data concerning terrestrial environmental arsenic concentrations in the vicinity of the U.S. Antimony site in Prospect Creek.



Chapter 5

RECOMMENDATIONS

1. Exclude wildlife from the settling pond site.
2. Defer further sampling of big game until additional data warrants.
3. Continue precautionary advisories of a public health nature as appropriate.
4. Design and conduct, as soon as is practicable, studies to define the extent of soil arsenic concentrations in the vicinity of the U.S. Antimony site.
5. Based upon the results of ⁴ above, determine further data needs (plants, animals) and conduct such studies.
6. Insure that such studies contain sufficient quality assurances to provide for validation of sample integrity; chain-of-custody; the reliability, accuracy and precision and uncertainty of data; and the archiving of all records, notes, data, and samples.



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APPENDIX E

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Below is a brief summary of the events concerning the history and operation of U.S. Antimony mining/milling operation along Prospect Creek southwest of Bon Falls. The emphasis of the listing concerns the question of water quality and possible contamination of big game from the tailings ponds.

- 12/3/59 U.S. Antimony (John Lawrence) purchases the antimony property. He begins making application to the State and Forest Service for the necessary permits.
- 1/26/70 Letter from RO-Watershed stating that we would support the State Health Dept. in development of the mine and mill. At this time, the State had regulations for handling such operations while the Forest Service surface mining regulations for mining were not to be enacted until 1974.
- 3/31/70 Letter from T. Falls Ranger District to U.S. Antimony noting tailing pond construction requirements. One stipulation mandated the drilling of 4 water quality monitoring wells to be 50-80 feet from the pond and 15-20 feet deep. (Surface water sampling from the stream began in 1970 while the well sampling began in 1971).
- 1/12/72 State Fish, Wildlife, and Parks was discontinuing the water monitoring program due to a lack of funding. No surface or ground water contamination was detected up to this time.
- 1/19/75 Mr. Lawrence proposed a new tailing pond in order to accommodate his expanded operation. The old, disused monitoring wells were covered over by the new pond and none drilled to replace them.
- 2/79 Water sample collected from the surface of the tailing pond show 20 ppm arsenic. Since wildlife were frequently seen drinking from the pond, the question of contamination of animals and their meat is raised.
- 1/80 Because of this concern, pressure is exerted on U.S. Antimony to fence the ponds. The fence is later erected after a newspaper article calls attention to the situation.
- 1/80 A news release by the FWP warn hunters of possible contamination of big game animals in the Prospect Creek drainage. FWP shoots several deer at the pond to test for arsenic poisoning. According to the State's analysis, there is no significant contamination.
- 1/13/80 A news release is jointly issued by the State and FS indicating that there was no problem with animal contamination.
- 1/7/83 Skip Rosquist, Loio Forest Hydrologist, voices concern for possible ground water contamination from the ponds. His suspicions were aroused by the discovery of arsenic in Milltown's water supply and the chance that the U.S. Antimony tailing ponds were inadequately constructed.
- While talking to Dr. William Woessner, Geology Prof at the Univ. of

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Montana, Skip finds that Dr. Woessner has funding for a ground water study but is without a location to investigate. Plans are made to initiate such a study at the U.S. Antimony pond site.

3/83

Dr. Woessner submits a study proposal in which a graduate student, Mark Snapley, would do the sampling for his thesis. Cooperation of Mr. Lawrence is secured. The Forest Service will provide a vehicle, aerial photos, use of a bunk house, and some drilling support, the Dept of State Lands would provide some funding (later withdrawn), and the Montana Water Resources Research Center at Bozeman would also supply funding.

3/83-7/84 Drilling of monitoring wells and taking of surface and ground water samples occurs.

7/20/84 While taking water samples, Mark Snapley noticed a dead deer within the fence enclosing the pond. The deer is near the fence along the pond shore. He notifies Skip Rosquist who in turn contacts the Ranger District. Efforts to locate the local FWP representative are unsuccessful. The idea is to take samples of the carcass to determine heavy metal contamination. The deer had been dead about a week before Mr. Snapley happened upon it.

7/30/84 Jerry Diebert, Plains R.D. biologist, collects a sample of what is left of the liver, kidney, and some rumen (stomach contents); the carcass was maggot infested making this process unpleasant.

8/23/84 After being turned down by several labs, Skip Rosquist finally got the State Crime Lab in Missoula to accept the sample for heavy metal analysis. Skip delivers the sample to them this day.

8/23/84 Results received from Lab show 50.2 mcg/gm arsenic in the liver and 42.2 mcg/gm in the kidney. (mcg = microgram; gm = gram; 1000 mcg equals 1 gram)

8/23-9/6 Skip and Mike Hillis, Lolo Wildlife Biologist, call various specialists to confirm that these are very dangerous levels of contamination. Written replies from Dr. Duwayne Hamer, Assoc Prof. of Veterinary Medicine, Colo State U., and Louis Locke, Wildlife Pathologist for the U.S. Fish & Wildlife Service in Madison, Wisc. confirm the toxicity levels.

1/7/84 At a meeting with the DSL concerning the Antimony mine held at the Plains R.D., this information was given to Kevin Jones of the DSL who says he will forward the info to the FWP.

1/14/84 Letter from Lolo Forest Supervisor Daniels acknowledging that the DSL is the lead agency in administering the U.S. Antimony operation (all but ponds are on private land). This was based on a proposed MOU between the RO and DSL.

1/18/84 FWP works up plan to shoot deer and elk and catch fish in Prospect Creek area to sample for heavy metal concentrations.

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- 1/12/84 Skip sends formal letter to DSL with copies of the State Crime Lab report and the letters from Hamer and Locke.
- 1/23/84 DSL sends letter to U.S. Antimony detailing shortcomings of its operation: need deer/elk proof fence, contain dust from ponds, monitor water quality, proper disposal of solid waste, and need additional bonding.
- 10/11/84 Presentation of Antimony study by Dr. Woessner and Mark Snapley to FS, DSL, and State Water Quality Bureau. Study shows leakage of elements from pond into the ground water system. Antimony levels exceed allowable limits adjacent to the pond but are diluted with- in a short distance downstream to below excess limits. This study was conducted during a time when the mill was inactive.
- 10/18/84 Anonymous call to T. Falls newspaper results in article concerning the dead deer and study.
- 10/19/84 Meeting at T. Falls with DSL, FWP, USAC, and FS to talk about the water study. The topic discussed, however, was the deer situation and whether to issue a news release. The DSL/FWP call their people in Helena and were told that no release will be given out until completions of a FWP sampling program. Mr. Lawrence is given a copy of the water study at this time.
- 84 DSL/FWP issue a news release warning hunters in the Prospect Creek area about potential animal contamination.



APPENDIX L



595 North Pastoria Avenue
Sunnyvale, California 94086
(408) 732-0940
Telex: 346399
Cable Address: FININSTRO

finnigan

December 14, 1973

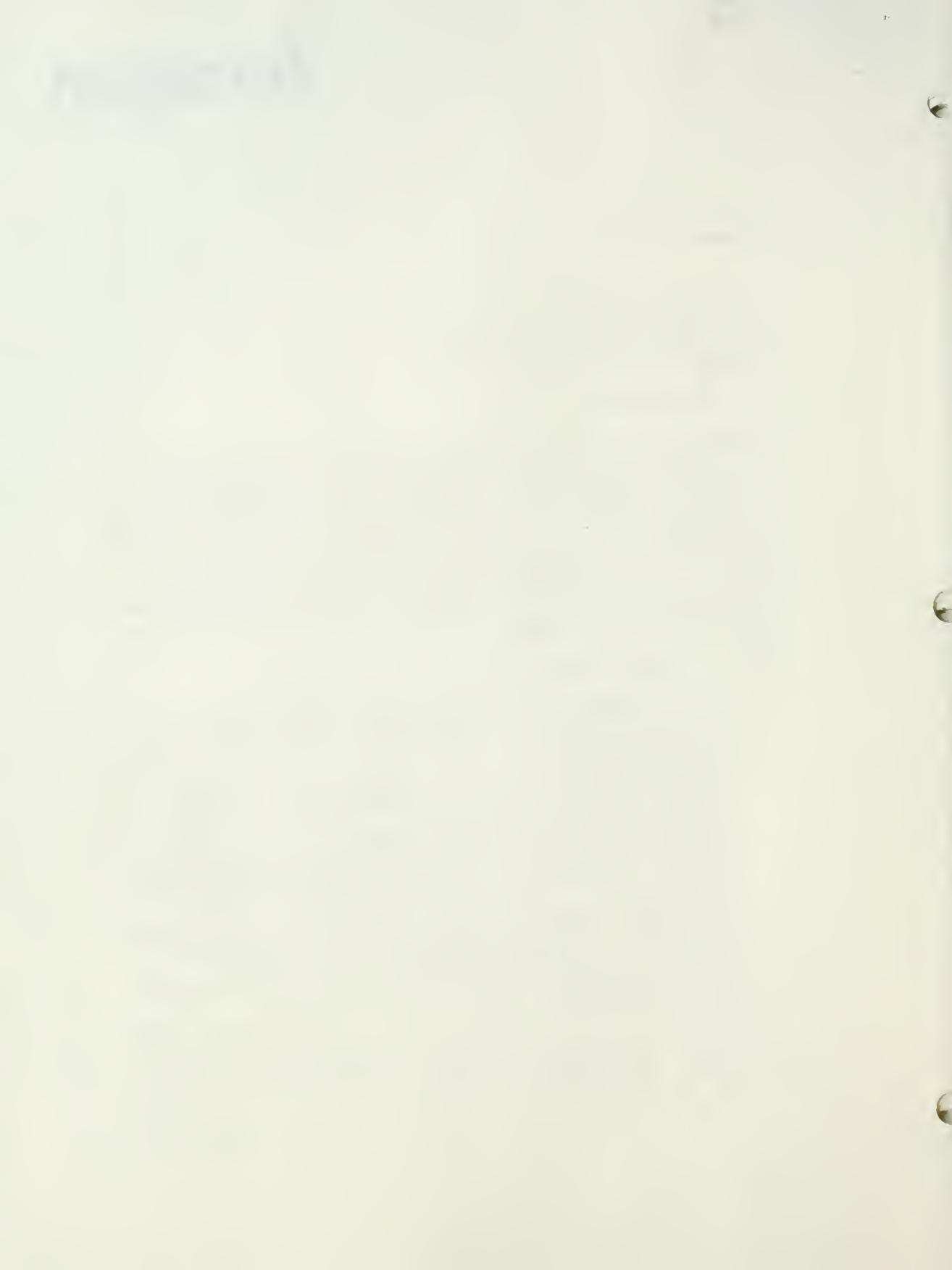
Mr. Arnold Melnikoff
Criminal Investigating Laboratory
Room 115, Wilma Building
Missoula, Montana 59801

Dear Mr. Melnikoff:

Enclosed is the data we obtained from samples taken at the area of the Tri-Creek Fire. Included with this data is a map showing where the samples were obtained indicated by reference points such as R2 P1 along with photos taken directly from the CRT of the X-ray system. The reference points are noted on the photos. The original data is being sent to you along with one copy. We will have a copy in our file, if you need more detailed explanation, please refer to the notation on photo and number on photo. It would be best to contact Jim Mathiesen, who is in charge of our X-ray Lab for detailed questions concerning the analysis.

Below is listed a short explanation of each photo.

1. ORE, Tri-Creek Fire - high level of Sb (antimony) & As (arsenic).
2. C1D. Fir Particles - Control taken 2 miles south. No Sb a very small amount of As.
3. R1-P1 Fir Particles - relative high level of both Sb & As.
4. R1-P1 DUFF - Shows about the same level as Fir particles taken at same location.
5. RI-PI D. Fir - The Fir needles show very low level of Sb & As.
6. RI-P3 D. Fir Particles - Location further from smelter. Shows a definite reduction in the level of both Sb & As compared to R1-P1.
7. RI-P3 Duff - Shows almost no Sb which indicates that the trees caught most of the Sb when samples are taken further from smelter. As is the same as control.
8. RI-P3 D. Fir - Needles shows very little Sb and no increase in As over control.
9. R1-P5 Fir Particles - Particles taken at 550 feet very little Sb and As.
10. C2 D. Fir Particles - 2nd control shows no Sb very little As.
11. R2-P1 D. Fir Particles - Samples show level Sb & As of almost the same as R1-P1.
12. R2-P1 D. Fir Particles - Much lower level Sb & As than R2-F1 which is a control sample 1/2 mile distance from smelter in rese



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13. R2-P5 D. Fir Particles - The Sb peak in this samples is larger than the Sb peak in R2-P3 D. Fir Particles however we are using the amount of Fe (iron) in the particles as an internal standard. The absolute height of Sb peak may vary for the same concentration of Sb if more particles are placed into the chamber or if we have the output sensitive increased therefore it is important when determining the concentration of Sb to compare it to the Fe peak in the particles as an internal standard. You should note that the ratio of Fe to Sb in both R1-P1 D. Fir Particles and R2-P1 D. Fir Particles is almost one to one; in R1-P3 D. Fir Particles and P2-P3 D. Fir Particles the ratio of Fe to Sb is 3 to 1; in R1-P5 D. Fir Particles and R2-P5 D. Fir Particles the ratio is about 6 to 1. The further away from the smelter the low the concentration of Sb in the D. Fir Particles. C1 D. Fir Particles which is the control shows no Sb.
14. Sample A Chips from inside of old pipe - shows Sb, As, and Fe.
15. Sample B Flakes from top of stack. Shows high levels of Sb. & As.
16. Sample C Metal of Point of origin with magnet no Sb.
17. Sample D Particles from furnace - large amount of Sb.
18. Sample E Moisture Soaked off Duff at point of origin of fire shows low levels of Sb which indicates that Sb from smelter and gotten into the area.

The sample of dirt taken from the point of origin of the Fire did not show any Sb, the sample was taken too deep.

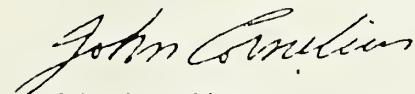
We did not attempt to relate the amount of Sb to an absolute amount since than we would have to make up standard.

What has been shown is that there is a relationship between the amount of Sb and the distant from the smelter. The closer to the smelter the higher the concentration in the samples.

If there are any questions on the data do not hesitate to contact us.

Sincerely,

FINNIGAN CORPORATION



John Cornelius
Western Regional Manager

JC:bh

c.c. Jim Mathiesen

Enclosures



Point of Origin

EAST

